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Abstract

METHODICS OF THE OPTIMISATION OF PARAMETERS OF A NUCLEAR POWER STATION WITH A HEAVY WATER MODERATED GAS-COOLED REACTOR

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1. Introduction

The submitted methodics of the optimisation of parameters for a nuclear power station is founded upon a consistent applying of the only one criterion of optimality for the using up of all degrees of freedom for to achieve the optimum of this criterion.

Because of its intricacy the optimisation so considered requests urgently the use of a digital computer and because of it, there is requested the creation of a full mathematic model.

2. A general formulation of the task

The mathematic model is composed of three parts, each of a different character.

The first of them is the sole criterion of optimality, which is a synthetic economic indicator created in harmony with the level and the needs of national economy. It may be expressed as a function of a certain number of physical-technical and economic quantities. It is universal for all optimisational computations of similar kind.

The second component is cost relation, expressing the dependence of the cost items upon the physical-technical parameters. The relations are dependent upon the level of the industry, and upon the material base and may be deduced on the ground of experiences with the building of nuclear power stations of the given type.

The third component of the mathematic model is creating relations, which describe mutual dependencies of individual, physical and technical

parameters of the equipment of the nuclear power station of the given conception variant.

From the mathematic point of view the model is a system of n equations (complemented with technical limitations), with m variables, and so with m-n degrees of freedom. The task commits in the finding of such values of independent variables, where the criterion reaches the optimal value.

3. Application of methodics

There were selected as a criterion of optimality the computational expenses that respect not only the simple but also the enlarged reproduction. The cost relations are deduced on the ground of the technical design of the first Czechoslovak nuclear power station with a heavy-water-moderated gas-cooled reactor. Physical-technical relations were elaborated for several variants of the same type, and differ what concerns the diameter of the vessel of the reactor, the arrangement of the active zone, and the type of the secondary circuit. Optimality calculations including the finding out of optima were made on a digital computer NE 803.

4. Conclusions

The results we have achieved made possible to find out an optimal variant of a nuclear power station and the basic influence of the initial parameters and so the impulses for further improvements of the nuclear power station of the type mentioned above were acquired.